ZZ board scan results update

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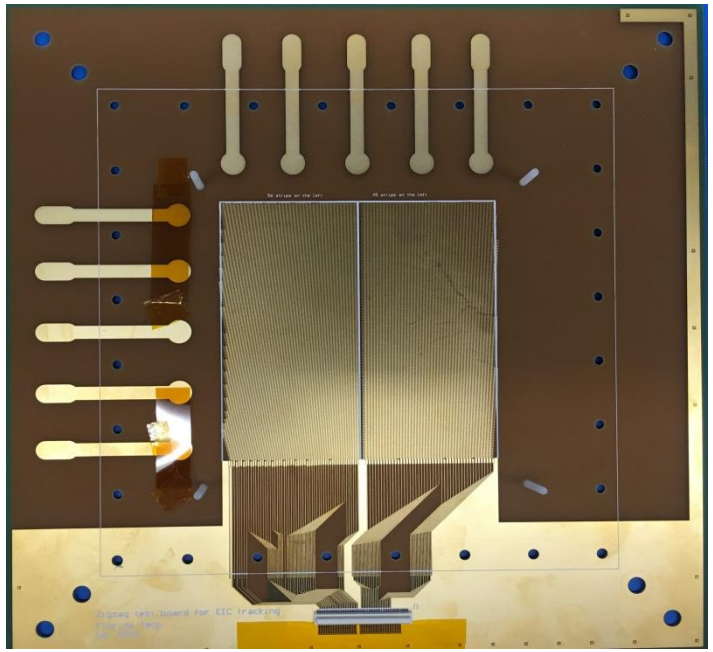
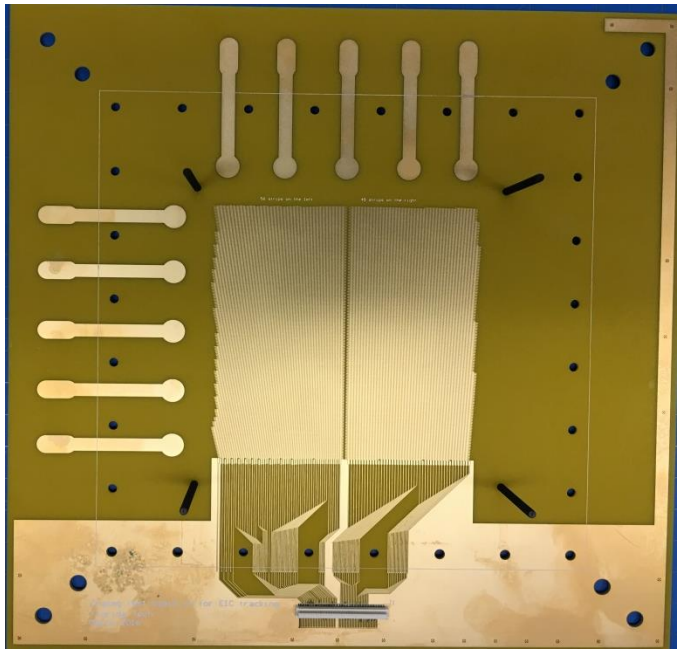
EIC tracking R&D biweekly meeting

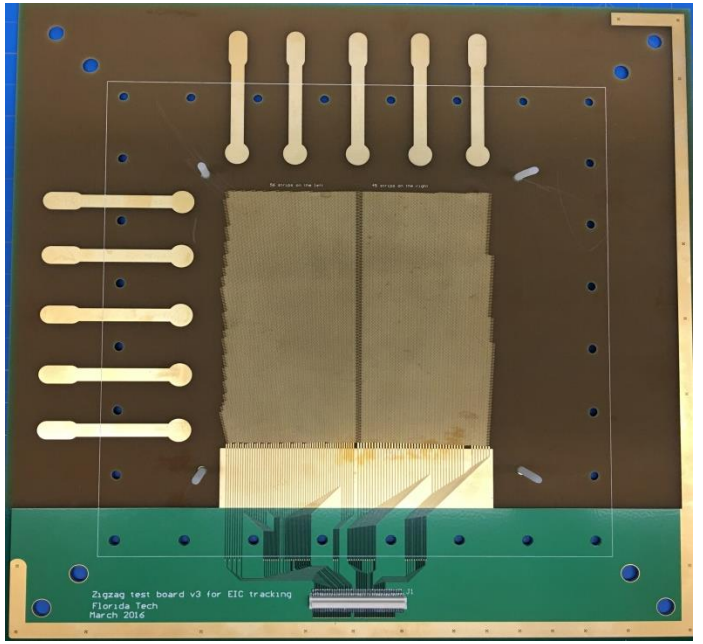
Board information



ZZv2
100% interleaving in design,
Outcome less than 100% interleaving.



ZZv3
100% interleaving in design,
Outcome very close to 100% interleaving



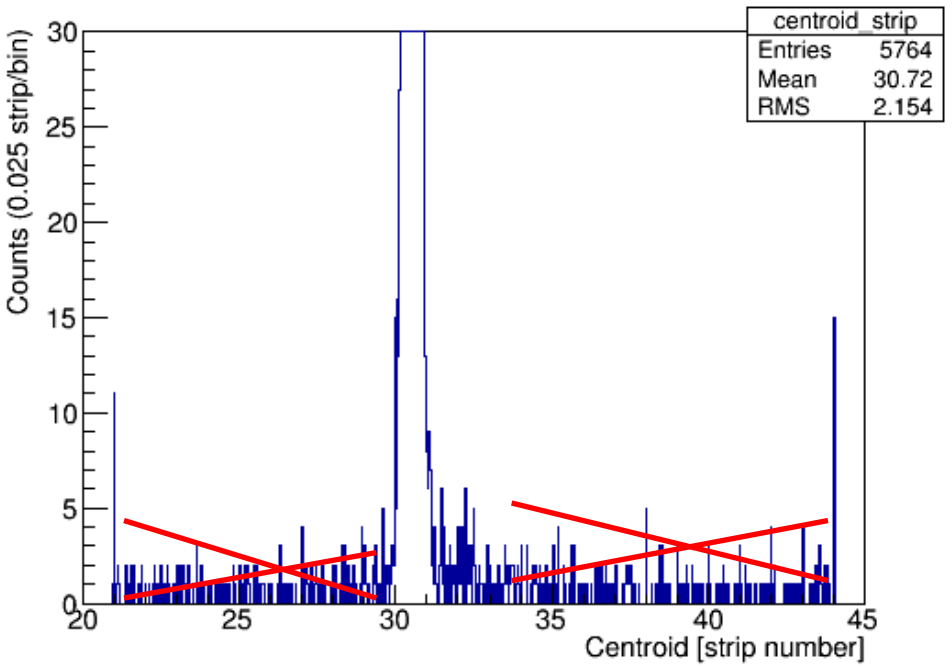
ZZv4
~130% interleaving in design,
Outcome a little more than 100% interleaving but with very small trace width

All boards were produced at Accurate Circuit Engineering (ACE)
Each board has two parts: (1) **56** strips on the left with an angle pitch **4.14 mrad** and R range 206 – 306 mm;
(2) **45** strips on the right with an angle pitch **1.37 mrad** and R range 761 – 861 mm.

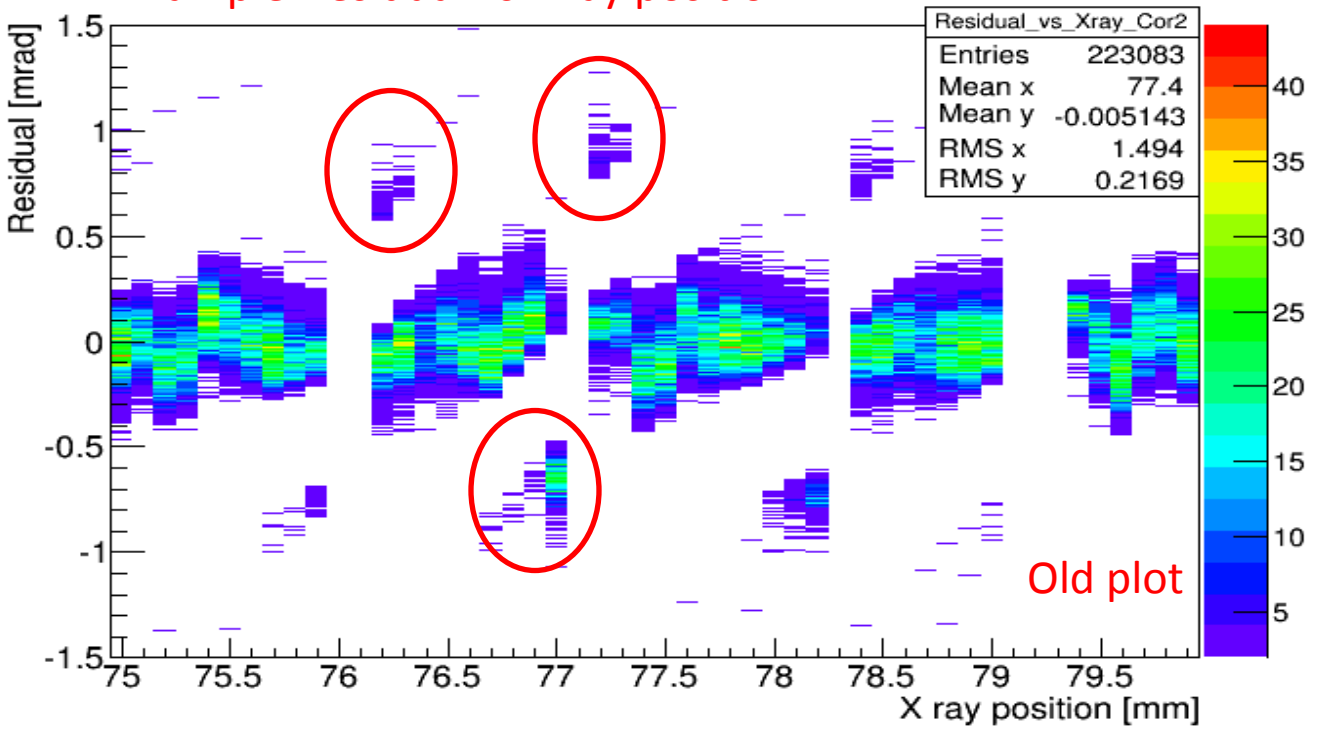
Note #1:

On the hit position distributions, there are hits beyond the X ray impinge position, which have residuals out of the normal range.

Example: centroid in strip number



Example: residual vs X ray position

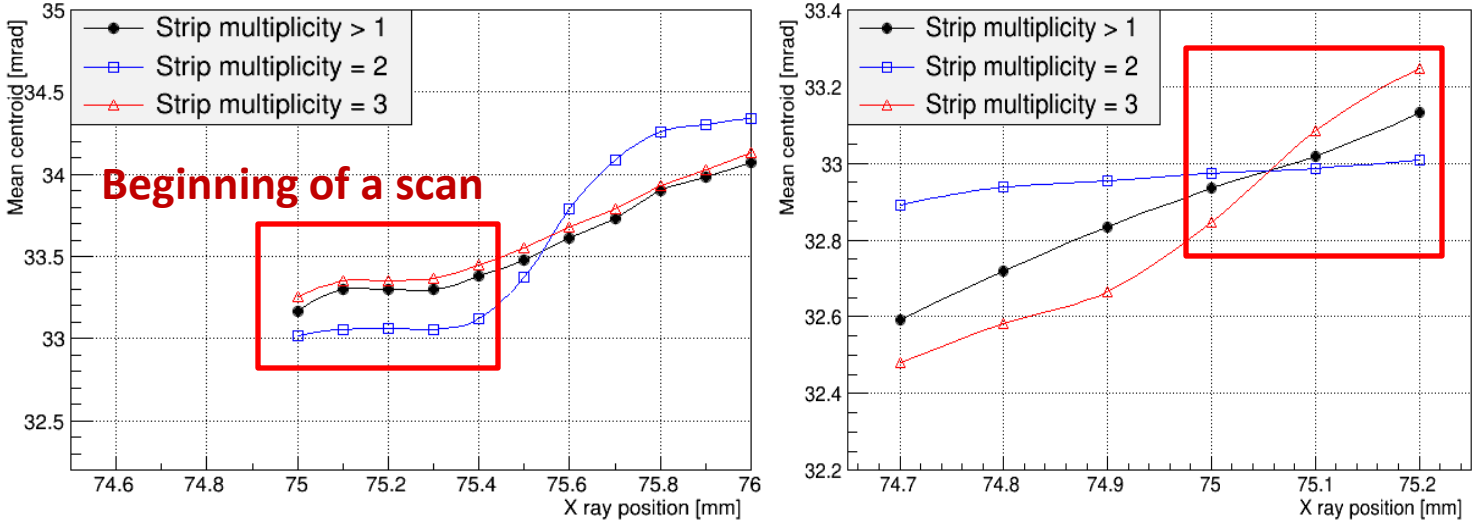


Therefore, in the new analysis, I exclude all hits that are not in the “reasonable” region. This works very good.

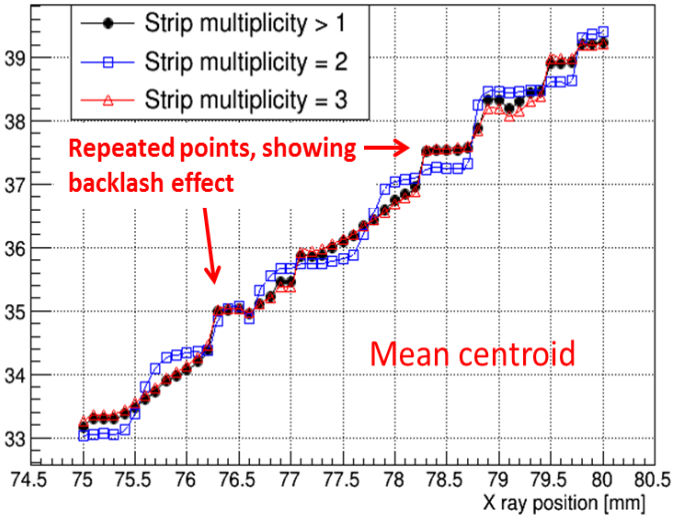
Note #2:

At the beginning of each scan (along X), we observe a “flat” region where centroid seems not changing. This could be caused by the **backlash** effect of motor motion.

In the last scan, I scanned a few points around the beginning place, and it shows flat region has gone.



Backlash also happens when I repeat some data points due to daq hangs.



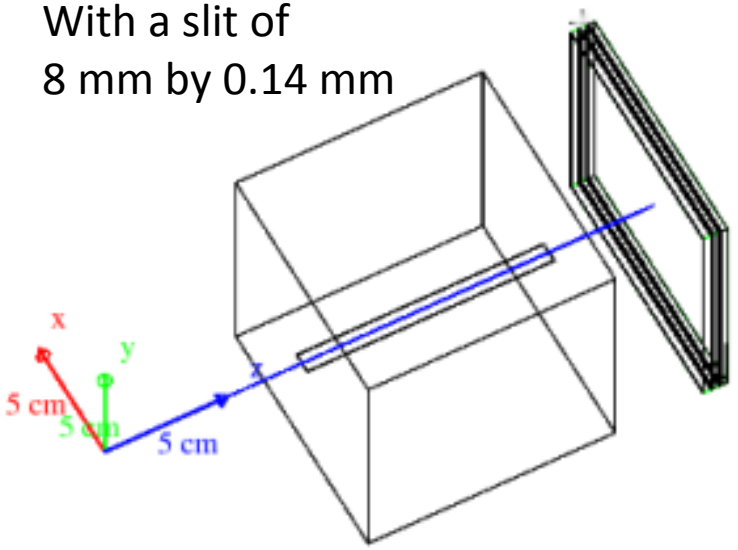
Therefore, in the new analysis, I exclude the points in the flat region in the beginning. (some runs even show backlash effect in the middle of scans or at the end of scans.)

Note #3:

The width of X ray is not measured, a simple simulation in Geant4 can estimate it.

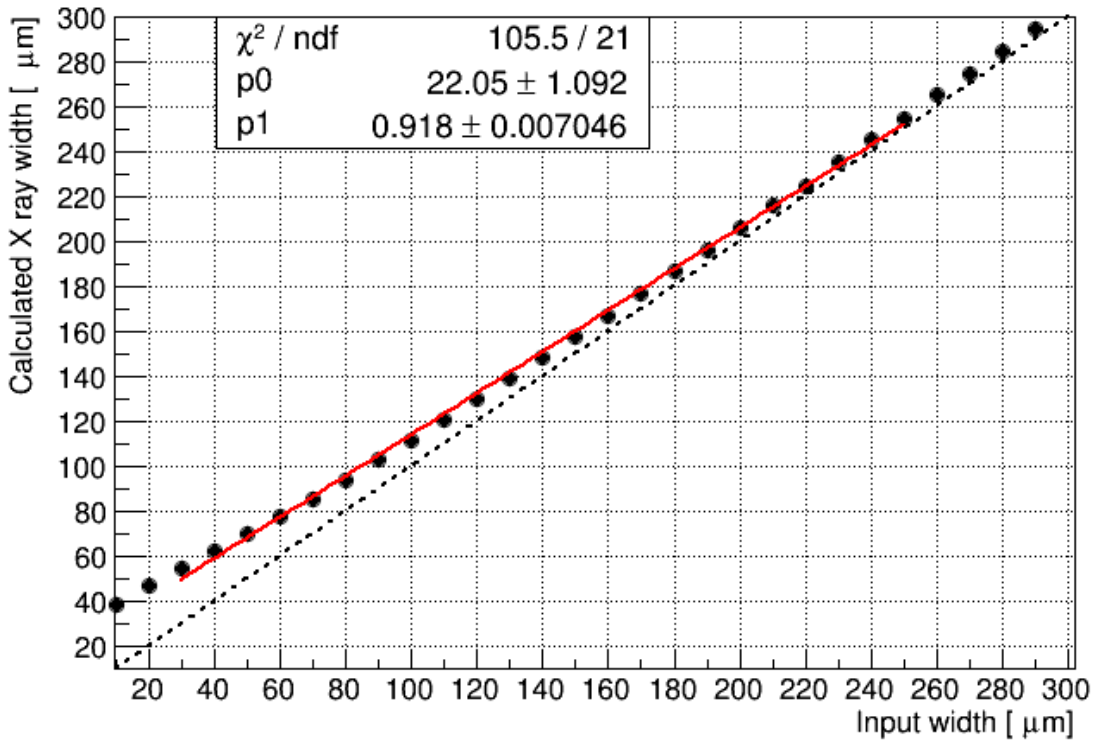
Shielding box,
With a slit of
8 mm by 0.14 mm

GEM



A cone beam (0.08 deg opening angle) is set 5 cm above the collimator.

Measured width vs. intrinsic resolution



The affect of (1) beam shape & distribution; and (2) distance is very small for this setup.

The intrinsic resolution can be extracted using the linear function from the simulation.

Resolution summary

Board		HV	Polar coordinate: Width in polar coordinate (μrad)			Cartesian coordinate: Width in Cartesian coordinate (μm)			X ray width subtracted: X ray width subtracted (μm)		
			Strip Multi = 2	Strip Multi = 3	Strip Multi = 4	Strip Multi = 2	Strip Multi = 3	Strip Multi = 4	Strip Multi = 2	Strip Multi = 3	Strip Multi = 4
Left part, Angle pitch 4.14 mrad, R: 229 mm	ZZv2	3380	339.1	437.1	-	77.6	100.1	-	60.5	85.0	-
	ZZv3	3200	472.8	323	-	108.3	74	-	94.0	56.6	-
		3380	400.6	225.8	-	91.7	51.7	-	75.9	32.3	-
		3480	388.8	514.2	394.3	89	117.8	90.3	72.9	104.3	74.3
	ZZv4	3250	151.6	622.8	317.9	34.7	142.6	72.8	13.8	131.3	55.3
Right part, Angle pitch 1.37 mrad, R: 784 mm	ZZv2	3380	79.2	90.9	-	62.1	71.3	-	43.6	53.6	-
	ZZv3	3380	124.6	98.03	-	97.7	76.9	-	82.4	59.7	-
		3480	110.2	134.8	-	86.4	105.7	-	70.1	91.1	-
	ZZv4	3250	39.49	157.3	-	31	123.3	-	9.7	110.3	-

- Overall resolution is < 100 μm!
- Board ZZv3 is the best in zigzag geometry (~100% interleaving), its resolution is close to the board ZZv2.
- Test board from CERN has arrived, and it is similar to board ZZv3. Will arrange a test on it soon.